The Great Wall of Debt: The Cross Section of Chinese Local Government Credit Spreads*

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Abstract

Issued by local government financing vehicles and backed mostly by land sales, chengtou bonds are an important source of financing for Chinese local governments. We identify large heterogeneity in chengtou bond yields, even though they are implicitly guaranteed by the central government. Factors reflecting China's aggregate credit risk and monetary policy are priced in the cross section. Reflecting the nature of their collateral, real estate variables are important drivers of chengtou bond yields, as are other macro fundamentals and liquidity characteristics. We find a significantly positive relation between chengtou bond yields and an index of local government corruption.

1 Introduction

Chengtou bonds are financial obligations of Chinese local governments. Capital raised through the chengtou bond market finances, to a large extent, the tremendous growth in both the size and the number of infrastructure projects in China—ranging from megaprojects like the $2.4 billion Shanghai Tower (the second tallest building in the world) to the housing estates sprouting in many cities. From 2008 to 2014, the chengtou bond market increases by 85% per year, and as of December 2014, there are RMB 4.95 trillion ($0.82 trillion) chengtou bonds outstanding. The brisk increase in chengtou liabilities goes hand-in-hand with the growth of total debt in China, which increases from 130% of GDP in 2008 to over 200% at the end of 2014.

Chengtou bonds are officially issued by local government financing vehicles (LGFVs), through which municipalities receive funds to supplement the direct transfers they receive from the central government. In a typical structure, an LGFV provides funds to a local government which is recorded as revenue, and the municipality in turn transfers land-use rights, or existing assets such as highways or bridges, to the LGFV. LGFVs issue chengtou bonds, literally translated as "urban construction and investment bonds," using the land-use right as collateral. Unlike municipal governments in the United States, Chinese local governments are not authorized to levy sales, property, or income taxes (with this arrangement dating from the budget law enacted in 1994). In addition, Chinese municipalities cannot directly borrow from banks or issue bonds, except with the approval from the State Council.When approved, the municipal bond issuance is done through the Ministry of Finance on behalf of the municipality. Since LGFVs are not subject to these restrictions, they are crucial sources of funding for local governments.

Figure 1 shows that the chengtou bond market expands dramatically since 2008. During the global financial crisis, Chinese authorities provide a RMB 4 trillion ($250 billion) stimulus package to counter slowing economic growth. Only RMB 1.2 trillion comes from the central government; the remainder of RMB 2.8 trillion is provided by local governments (see Lu and Sun, 2013). Given the restrictions on loans and on municipal bond issuance, municipalities rely extensively on chengtou bonds to raise funds during this period. In addition, China's promotion scheme for local government officials, where officials are rewarded for increasing revenue and meeting official targets set by the central government (cf. Li and Zhou, 2005), imparts additional pressure to seek financial resources—including land sales and issuance of chengtou bonds—which fall outside the usual channels requiring authorization from the State Council.

While the large size, fast growth, and the central role in developing the infrastructure of China make the chengtou bond market interesting to study in and of itself, there is one feature that makes it uniquely suited to investigate the effect of government guarantees, political risk, and distortions to market pricing induced by such effects. Though chengtou bonds are set up by local governments, they are implicitly guaranteed by the central government.[1] Under China's fiscal and tax system, the central government takes final responsibility for revenues and deficits of local governments, consistent with the fact that direct debt issuance and borrowing must be approved by the central government. Chengtou bonds are ultimately local government obligations and thus are also backed by the central government. Local governments do not, however, need approval of the central governments to set up LGFVs which issue chengtou bonds. We show that despite the tacit endorsement by the central government, chengtou bonds yields exhibit significant *economic* heterogeneity across provinces.[2]

The dispersion of chengtou bond yields also provides an interesting setting to study political risk factors and their influence on local government credit spreads. While corruption and political connections influence market prices even in developed countries—Butler, Fauver, and Mortal (2009), for example, uncover a significantly positive relation between high levels of corruption and high yields of U.S. municipal bonds at issue—there is a significantly higher level of corruption, combined with greater opacity, in China. Not surprisingly, many academic studies use Chinese markets and socioeconomic circumstances to study the economics of corruption and political interference (see, among many others, Fisman and Wang, 2011, 2013). An advantage of studying chengtou bond market is that its collateral is linked to the real estate market, allowing us to measure fundamental economic health in the bonds' issuing provinces.

Another defining characteristics of chengtou bond market is that it is an integral part of China's shadow banking system. The shadow banks—trust, securitization, insurance,

[1]Other markets where policymakers have set, or have an undue influence, on prices often involve a limited number of securities: foreign exchange pegs at one extreme, for example, involve only one price—the exchange rate (cf. Husain, Mody, and Rogoff, 2005). Other markets with a large cross section of securities with government guarantees have such guarantees suddenly imposed, and the guarantee does not extend to all securities within that asset class. For example, only certain bonds issued by financial institutions are suddenly guaranteed by governments during the financial crisis (see Levy and Schich, 2010).

[2]There are few academic papers studying chengtou bonds. Lu and Sun (2013) describe the function of LGFVs and discuss their role in China's credit expansion. Our paper is more related to Wang and Yu (2014), who use a small sample of chengtou bonds to study how the risk of various considerations involved with structuring LGFVs can determine chengtou bond yields. Wang and Yu (2014) do not examine whether macro, province-level risks, and market trading characteristics are priced in the whole cross section of chengtou bonds.

and leasing companies, and other non-bank financial institutions—hold large amounts of chengtou bonds and are increasingly exposed to local government default risk (see Wu and He, 2014). Thus, local government debt may represent a source of systemic risk to China and, given China's large size, potentially even to the world economy. In this sense, China is special since other local government bond markets, like U.S. municipal bonds, do not carry systemic risk. Reflecting their important role in China's financial system, we find that chengtou bond yields are sensitive to variables reflecting aggregate credit risk and monetary policy.

We find that provinces with larger chengtou bond factor loadings on China's credit risk, as proxied by changes on Chinese sovereign CDS spreads, and larger loadings on effective real exchange rate changes have significant positive and negative prices of risk, respectively. The former result is consistent with the tight link between local and central government finances: as China becomes riskier, yields of chengtou bonds in provinces most exposed to central government risk increase. The latter result is possibly driven by provinces with a strong export sector whose local economies, and thus municipal budgets, improve when the effective real exchange rate depreciates. All else equal, this tends to decrease chengtou bond yields.

We find significant explanatory power of issue province characteristics, including macroeconomic conditions, market structure, and broader financial conditions, for the cross section of chengtou bond prices. Some of the most important drivers of chengtou bond yields are conditions in the real estate market, reflecting the central role of real estate as LGFVs' collateral and the fact that real estate plays a key role in the economic development of China. In particular, the coefficient on the value-added real estate GDP ratio, stated as a percentage of total local GDP, is negative and significant: an increase of one standard deviation in the cross section of real estate GDP corresponds to a decrease in chengtou bond yields of approximately 0.20%. We also find that chengtou bond yields reflect political risk. Using a novel dataset manually collected based on the officials investigated by the Central Commission for Discipline Inspection, we find a statistically significant and economically meaningful positive relation between risk-adjusted chengtou bond yields and the corruption index.

The rest of this paper is organized as follows. Section 2 provides further background on the growth and characteristics of the chengtou bond market. In Section 3, we describe how we construct chengtou bond yields in excess of matched central government bond yields, and detail the national and province-level macroeconomic barometers, bond characteristics, and

our corruption index. Section 4 contains the empirical results. We first estimate the prices of macro risk in the cross-province chengtou bond yields, and then investigate if province-level characteristics, corruption risk, and chengtou bond market liquidity also have explanatory power. We conclude in Section 5 with a discussion on the relevance of our findings to China's current policies.

2 Local Government Finances and Chengtou Bonds

Our data on chengtou bond issuance and transaction come from Wind Information Co. (WIND), which provides information on Chinese financial markets. Table 1 and Figure 1 report the number of bonds issued and the issue amounts from 1997 to 2014. Both the numbers of bonds issued and the issue amounts are negligible before 2005 but since the fiscal stimulus in late 2008, the growth in chengtou bond market is very fast. The number of bonds issued in 2009 jumps to 258 compared with just 79 in 2008. The post-2008 average growth rate of new issues is 85% per year. In 2014, the number of new chengtou bond issues reaches 1,704, with a total amount outstanding of RMB 4.95 trillion ($0.85 trillion). Decomposing the issue amounts of bonds by maturity in Figure 2, the bonds issued before 2008 are mainly long-term and very short-term bonds. Since the global financial crisis of 2007-2008, the bonds issued mainly have a maturity of three to seven years, and these tenors account for 66% of the total issued bonds in 2014.

Figure 3 shows the relations of important institutions involved in the local government debt market in China. According to China Central Depository & Clearing Co., outstanding chengtou bonds are held mainly by commercial banks (31.0%), funds (24.8%), and insurance companies (21.4%)— the latter two types of investors belong to China's shadow banking sector. As the issuers of chengtou bonds, LGFVs do not count its liabilities as official debt. Nevertheless, LGFV liabilities are backed by local governments, and thus chengtou bonds represent a very large off-balance sheet obligation. The central government is ultimately responsible for all local government finances. LGFVs (which include state-owned enterprises) also have tight business connections with commercial banks.[3] LGFVs use the land transferred from local governments as collateral for bank loans. Thus, many financial institutions and financing sources are interlinked through issuing, holding, or collateralizing chengtou bonds.

[3]Commercial banks cannot directly lend to local governments. According to China's National Audit Office, commercial banks are the primary financing source for local governments mainly through their loans to LGFVs.

Given these relations, rapidly decreasing land prices may be a trigger for a systemic event as LGFV collateral consists of property, land-use, development rights, and other real estate-related assets. In normal times, land value increases and LGFVs are able to rollover debts without increasing their costs of financing. In stressed times of low land prices, debt holders may demand more collateral, which increases financing costs and generates a significant rollover risk for LGFVs. One way to meet the shortfall is to sell land, but the fire-sale in an illiquid market would create a vicious circle. Indeed, revenue from the sales of land-use rights constitutes a principal source of local government revenue. In the United States, decreasing real estate prices played a major role in many bankruptcies of over-leveraged savings and loan banks in the 1980s and 1990s (see Case, 2000) and the subprime mortgage crisis of 2007 (see Brunnermeier, 2009). In our empirical work, we investigate how real estate values and financial market conditions influence chengtou bond prices.

There are other sources of local government revenue besides those associated with chengtou bonds, including direct transfer from the central government, loans, and municipal bond issues. Except for chengtou bonds, none of these have market prices.[4] In so far as chengtou bonds reflect risk that is shared by other types of local government financing—credit risk, geography, exposure to local economic growth and real estate conditions, fiscal health of the issuer and issuing province, among others—the relatively transparent chengtou bond market provides a window to appraise the risk exposure of Chinese municipalities in general, and to examine how that risk is related to broad financial market and macro factors. In particular, the relations we uncover between chengtou bond yields and real estate variables, and aggregate monetary policy and economic growth factors, are of interest to the broad policy debate on Chinese local government finances.

2.1 Other Characteristics of Chengtou Bonds

The rapid expansion of the chengtou bond market goes hand-in-hand with higher yields, which is consistent with investors perceiving greater risks with increasing LGFV liabilities. Table 2 reports that yields of newly issued bonds increase from an average value of 3.5% in 2007 to 6.9% in 2014. There are increases in yields even for short-term bonds with a maturity less than one year; such bonds exhibit yield increases from 2.7% in 2009 to 5.4% in 2014. Moreover, the average maturity drops from 6.0 years in 2009 to 5.3 years in 2014, implying

[4]Directly issued municipal bonds are sold over-the-counter, and there are no public figures on original issuance or secondary-market transactions, except for nationwide total issuance information that is published by the central government.

that investors prefer shorter-term maturities as the risks of chengtou bonds increase.

Table 3 summarizes chengtou bond issuance by each province. In 2014, there are 30 provinces which issue chengtou bonds. The top five provinces with the largest amounts outstanding are Jiangsu, Zhejiang, Beijing, Shanghai, and Guangdong. These provinces represent 40% of the total RMB 2.34 trillion chengtou bonds outstanding. These are all coastal provinces, except for Beijing which is the capital. The five provinces with the smallest issuance are Ningxia, Hainan, Jilin, Qinghai, and Shanxi. With the exception of Hainan, these are all interior provinces.

Chengtou bonds are rated from A to AAA, with the short-term note rating from A1 to A1+. Each bond is rated at issue by one of the five major credit rating agencies: (i) China Chengxin International Credit Rating Co., Ltd.(a joint venture with Moody's); (ii) China Lianhe Credit Rating Co. Ltd. (a joint venture with Fitch Ratings); (iii) Dagong Global Credit Rating Co., Ltd.; and (iv) Pengyuan Credit Rating Co., Ltd.; (v) Shanghai Brilliance Credit Rating & Investors Service Co., Ltd. (in partnership with S&P). We quantify bond ratings by assigning numerical values, where higher numbers indicate higher credit quality. We assign a value of six to the highest rated bonds (AAA), a value of one for the lowest rated bonds (A), and fill in the numbers in between. Except for non-rated bonds (16% of the total issuance), 18% of bonds have a rating of AAA at issue, 27% are rated AA+, and 37% are rated AA. The lower-quality bonds with AA-, A+ and A ratings only account for 1.5% of the total issuance.

3 Data

In Section 3.1, we define chengtou bond excess yields which constitute the dependent variable of our analysis. We report considerable heterogeneity in excess yields across time and provinces in Section 3.2. Sections 3.3 and 3.4 detail our nationwide and province-level macro variables, respectively. We construct a corruption index in Section 3.5. Finally, Section 3.6 describes various liquidity characteristics of chengtou bond market.

3.1 Chengtou Bond Excess Yields

A well-known fact in fixed income is that all yields are highly correlated with the level of government bond yields, or the "level" factor (see Knez, Litterman, and Scheinkman, 1994). We construct yields in excess of matching central government bond yields to isolate the yield spreads in the chengtou bond market. We need to control at least for duration because of

the very different maturities at issue (see Figure 2), but our matching procedure also takes into account convexity and other effects because we control for all cash flows of the chengtou bond.

We define the excess yield as the difference between the chengtou bond yield and the matched central government bond yield:

$$Y_{ij}(t) = y_{ij}^{CTB}(t) - y_i^{CGB}(t), \tag{1}$$

where $y_{ij}^{CTB}(t)$ is the yield for chengtou bond i in province j at time t, which we calculate based on the transaction price at time t. We take the central government bond yield at time t, $y_i^{CGB}(t)$, which has the same cash flow characteristics as chengtou bond i.

To compute the matching central government bond yield, $y_i^{CGB}(t)$, we use the zero-coupon rates of Chinese government bonds, which we compute as follows. We take daily transaction records from WIND on Chinese central government bonds at time t satisfying the following criteria: (1) there are at least 20 bond transactions, (2) the time-to-maturity of these bonds spans at least 10 years, and (3) we exclude bonds with remaining maturity less than one month. We fit the zero curve following Svensson (1994), who assumes the following functional form for the instantaneous forward rate, f:[5]

$$f(m,\theta) = \beta_0 + \beta_1 \exp\left(-\frac{m}{\tau_1}\right) + \beta_2 \frac{m}{\tau_1} \exp\left(-\frac{m}{\tau_1}\right) + \beta_3 \frac{m}{\tau_2} \exp\left(-\frac{m}{\tau_2}\right), \tag{2}$$

where m denotes the time to maturity and $\theta = (\beta_0, \beta_1, \beta_2, \beta_3, \tau_1, \tau_2)$ are model parameters to be estimated. The forward curve in equation (2) is understood to apply at time t. Using the parameterized forward curve, we derive the corresponding zero-coupon central government bond yield curve at time t over different maturities s, $\{r_s(t)\}$.

To find the matching central government bond yield for chengtou bond i, we hold fixed bond i's characteristics—coupon type, coupon rate, coupon frequency, and maturity date—at the time of trade and discount each cash flow using the central government bond zeros:

$$P_i^{CGB} = \sum_{s=1}^{T} \frac{C_i^{CTB}}{(1 + r_s(t))^s} + \frac{100}{(1 + r_T(t))^T}, \tag{3}$$

for maturity T, coupon C_i^{CTB} and the prevailing central government zero curve at time t is $\{r_s(t)\}$. With the implied government bond price P_i^{CGB}, we calculate the corresponding

[5]The Svensson (1994) model produces smaller fitting errors than the Nelson and Siegel (1987) procedure.

yield, y_i^{CGB}, which we define as the matched central government bond yield for chengtou bond i. Equation (3) effectively prices bond i as a Chinese central government bond because it uses that series of discount rates (see Duffie and Singleton, 1999), and is thus more accurate than just matching on duration or maturity because it controls for all the cash flow effects unique to each chengtou bond.

We calculate the chengtou bond-level excess yields at the daily frequency, and then aggregate to the monthly frequency and/or province level depending on the research design, which we detail below. In our final sample, there are 20,357 bond-month observations issued in 28 provinces from August 2007 to December 2014.

3.2 Excess Yields across Time and Provinces

Under China's current fiscal and tax system, the central government is ultimately responsible for all revenues and deficits of local governments. If investors perceive that chengtou bonds have an inviolable central government guarantee, there should be no predictable cross-sectional variation in excess chengtou bond yields and we should expect to observe the same average chengtou bond yields across provinces. Is this true?

Figure 4 plots the dispersion of excess chengtou bond yields at issue in Panel A and in the secondary market in Panel B. The graphs reveal that chengtou bond excess yields are persistent, with a first-order autocorrelation of 0.79. We mark the median value along with the 10th and 90th deciles from 2005 to 2014. Evidently, there is large heterogeneity in excess yields across issues, and it occurs in both the primary and secondary markets. In the primary market, the average range between the 10th and 90th deciles is 2.95% with a standard deviation of 0.95%. The corresponding range for for the 10th and 90th percentiles in the secondary market is 1.84% with a standard deviation of 0.87%. Figure 4 shows that the excess bond dispersion changes over time, and tends to increase when the median excess yield is high. This suggests that the market more finely distinguishes different underlying risks of chengtou bonds across provinces when overall market conditions deteriorate.

Table 4 reports the summary statistics of excess yield for the whole sample. Overall, chengtou bonds earn a premium of 1.98%, on average, over matching central government bond yields. Table 4 also reports summary statistics of subsamples broken down by province characteristics based on: 1) geography, 2) real estate rank (measured by the average price per squared meters during 2008 to 2012), 3) local GDP growth rate, and 4) the local fiscal gap to GDP ratio. Table 4 shows that there is predictable variation in excess yields across provinces: more expensive bonds (lower yields) tend to be those issued in provinces located

along the coast, those bonds issued in provinces exhibiting higher housing prices, and issuing provinces with lower GDP growth rates and smaller fiscal gaps.

In summary, we find large cross-sectional heterogeneity in excess chengtou bond yields even though chengtou bonds are guaranteed by the Chinese central government; the market seems to perceive that all chengtou bonds are not equal. We now describe potential risk factors which may be priced in the cross section of chengtou bonds.

3.3 Nationwide Economic Barometers

We collect national variables to calculate province risk exposures. We select these national variables on the basis that they capture China's solvency risk, monetary policy, and financial market conditions. We employ the following abbreviations:

CDS	Chinese credit default swap rate
FDI	Foreign direct investment in China
CA	Log of the current account
FX	Effective real exchange rate
RF	One-year time deposit interest rate
RET	Shanghai stock exchange market return (including all A-shares and B-shares)

Credit default swap rates (CDS), foreign direct investment (FDI), and current account (CA) all capture different aspects of solvency risk. For monetary policy proxies, we use the effective real exchange rate (FX) and the one-year time deposit interest rate (RF). The latter as the benchmark interest rate in China. For China's financial market conditions, we take the Chinese stock market index (including all A-shares and B-shares) and use the market-weighted return (RET). The nationwide variables come from WIND, the National Bureau of Statistics, and Global Financial Data, and are available at the monthly frequency from January 2005 to December 2014.

3.4 Province-Level Economic Barometers

We expect that chengtou bond yields should reflect the underlying quality and price dynamics of their collateral, real estate, and general economic growth. We obtain province-level economic indicators from the National Bureau of Statistics and WIND. These variables

reflect the local economic and fiscal conditions and are all available each year over 2005 to 2014 for each province:

GDP Growth	Log difference of real GDP
Fiscal Gap	Difference of revenue and expenditure, scaled by local GDP
Real Estate GDP	Ratio of real estate value-added GDP to total GDP
Service GDP	Ratio of service value-added GDP to total GDP
Retail GDP	Ratio of wholesale and retail value-added GDP to total GDP
Hotel GDP	Ratio of hotel industry value-added GDP to total GDP
Land Cost	Total amount of RMB used to purchase land as a ratio of local GDP
Loans to Real Estate	RMB amount of loans to real estate companies in each province scaled by local GDP

3.5 Corruption Indices

Corruption in China seems to be endemic. The Carnegie Endowment estimates that the cost of corruption in China in 2003 is $86 billion, or 3% of GDP, and in 2013 this increases to 13% of GDP.[6] Our primary measure of a province's political risk is the weighted ranking number of officials named in the graft probes by China's Central Commission for Discipline Inspection (CCDI).

We manually compile a list of individual officials in graft investigations published on the CCDI's website since 2012 (when President Xi took office) to 2014. There are a total of 753 officials named in the graft probes, covering all 31 provinces. We further collect information on corrupt officials' titles and rankings, and categorize individuals into seven rankings. The final index number, which we denote as *Corruption*, is a weighted ranking of corrupt officials in each province. A higher index number suggests more severe corruption for the province, and hence may correspond to greater political risk. We also use the number of officials listed in the graft cases in each province as an alternative proxy of political risk, which we denote as *Number of Corruption Cases*. The average corruption index number is 2.1 with a standard deviation of 0.4 across 30 provinces whose LGFVs issue chengtou bonds. On average, there

[6] See www.carnegieendowment.org/files/pb55_pei_china_corruption_final.pdf. In 2012, the Communist Party of China launches an anti-corruption campaign. Following President Xi's proclamation, the CCDI is "striking tigers and flies at the same time"—a reference to investigating corrupt high- and low-level officials.

are 21.2 cases investigated for each province, with a standard deviation of 13.7 cases. The number of officials named in the graft report varies across provinces: Tianjin and Guangxi, for example, each have four cases in our sample, whereas Shanxi has 49 cases, and Sichuan and Hubei have 50 and 51 cases, respectively.

3.6 Liquidity

After issuance, chengtou bonds trade mainly in the interbank market, which has a market share of 68%. They also trade in the Shanghai and Shenzhen stock exchanges, with these venues capturing a market share of 30%. For each bond transaction on day t, we observe its open and closing prices, the highest and lowest price, the mid price, trading volume, and the yield to maturity. To obtain accurate bond pricing information, we only keep bonds which trade on the interbank or exchange markets, and screen out bonds with special terms such as callable or putable bonds.

To get a sense of the overall market liquidity, we calculate the trading frequency as the number of traded bonds divided by the total number of outstanding bonds in each month. The monthly trading frequency is below 30% before 2006, jumps to 65% in 2007, remains stable between 60% to 70% after August 2007. Given our object of interest is the cross section of chengtou bonds, we choose our final sample to cover the relatively liquid period from August 2007 to December 2014.

We compute three bond-level liquidity statistics:

Turnover is the ratio of trading volume to the outstanding amount, which we compute at the monthly frequency. We sum across trading days within each month to obtain the monthly trading volume. We take the amount outstanding at the end of the month.

Following Amihud (2002), *Amihud* is defined for bond i as

$$Amihud_i = \frac{1}{N_t} \sum_t \frac{|R_{it}|}{Vol_{it}}, \tag{4}$$

where R_{it} is bond i's return on day t, Vol_{it} is bond i's trading volume on day t, and N_t is the number of days where bond i trades that month.

High-Low Spread is the difference between daily high and low prices.

We report summary statistics of the liquidity measures in Panel B of Table 4. The average spread is 0.21 with a standard deviation of 0.74. The average monthly turnover

ratio is 42.6% and the average Amihud liquidity measure is 32.9. In sum, the chengtou bond market is relatively illiquid.[7] Thus, we might expect the cross section of chengtou bonds to exhibit an illiquidity premium, as is the case for equity and bond markets (see, for example, Pástor and Stambaugh, 2003, and Bao, Pan, and Wang, 2011, respectively).

4 Empirical Results

We first investigate how nationwide risk variables are priced in the cross section of chengtou bond yields. Section 4.1 details how we compute province risk exposures, and we estimate the coefficients on those risk exposures in cross-sectional regressions in Section 4.2. Sections 4.3 to 4.5 discuss how real estate risk, political risk, and liquidity characteristics are priced, respectively.

4.1 Risk Exposures

We compute province-level betas with respect to national macroeconomic and financial market conditions with the following empirical model:

$$\Delta Y_{jt} = \alpha_j + \beta_{j,F} \Delta F_t + \varepsilon_{jt} \tag{5}$$

where ΔY_{jt} is the monthly change of province-level excess yields, which are computed by averaging across all bond-level excess yields issued in province j during month t.

We run the regression (5) for each province j using the full time-series of excess chengtou yields from August 2007 to December 2014, a total of 89 monthly observations. The right-hand side variable, ΔF_t, is the change of the macro risk factor over month t. We take the macro variables described in Section 3.3. The factor loadings, $\beta_{j,F}$, in equation (5) are analogous to betas computed in the equity cross section; the factor loadings measure the contemporaneous response of bond yields to changes in macro conditions.

Panel A of Table 5 reports summary statistics of the distribution of betas. The betas exhibit significant variation across provinces, with the largest dispersion between the 10th and 90th percentiles being 1.17 for betas on the change in the one-year time deposit rate (ΔRF) and 1.79 for betas on the Chinese stock market return (RET).

In Panel B of Table 5, we sort provinces into three portfolios: Low, Medium, and High

[7] But chengtou bonds are significantly more liquid than U.S. municipal bonds, see Ang, Bhansali, and Xing (2015).

based on the betas for each factor. We report the excess chengtou bond yields in the Low and High portfolios, along with a t-test for the average difference. There are significant differences in the excess yields for all the macro factors, except for the exchange rate betas. Provinces with higher betas to China's CDS tend to have higher yields, with the difference between the Low and High portfolios being -0.24%. Provinces with higher betas to direct foreign investment also tend to have higher yields. These univariate portfolio sorts suggest that chengtou bonds reflect macroeconomic, credit, monetary policy, and financial conditions. We now formally estimate prices of risks for these nationwide risk factors in a cross-sectional regression, which is able to jointly control for the effect of multiple risk factors.

4.2 The Price of Macro Risk

We estimate the following panel regression:

$$Y_{jt} = \alpha_0 + \alpha Y_{j,t-1} + \sum_{k=1}^{K} \gamma_k \cdot \beta_{j,F(k)} + \varepsilon_{jt}, \tag{6}$$

where $\beta_{j,F(k)}$ is the risk exposure of province j to risk factor $F(k)$, and γ_k is the price of risk of factor $F(k)$ with $k = 1, \ldots, K$ risk factors in the regression. We run equation (6) using the first-pass betas estimated in equation (5). We also include the lagged yields on the right-hand side because chengtou bond spreads are persistent (see Figure 4).

Table 6 reports the results. Columns (1) to (6) are univariate regressions. The regressions show that nationwide macro factors are priced in the cross section of chengtou bonds. In particular, the prices of risk for CDS, foreign direction investment (FDI), current account (CA), and the one-year time deposit rate (RF) are significantly different from zero. The magnitude of the coefficients is economically large. For example, the difference between the 10th and 90th percentiles for the beta with respect to CDS changes is 0.50 (see Table 5). Multiplying this by the coefficient of 0.35 on the CDS factor equals 0.18%—thus, the coefficient represents a risk premium change of 0.18% moving from the 10th to 90th beta percentiles. This is an effect representing close to 10% of the average 1.98% chengtou bond risk premium.

Several of the variables are correlated, so some of the significance changes in the multivariate regressions which we report in in columns (7) and (8), with and without the lagged yield, respectively. Nevertheless, CDS and RF remain significant in the multivariate regression (7). In the multivariate specifications, the real effective exchange rate, FX, is

also significant. The positive coefficient on China's sovereign risk suggests that chengtou bonds are economically levered versions of sovereign credit risk—the larger the exposure to China's solvency risk, the higher are chengtou bond yields. The negative coefficient on the real effective exchange rate may be due to government finances in provinces with high exchange rate betas benefiting from increased exports when the RMB depreciates.

Finally, the regression (8) contains the lagged yield. This carries a large, positive coefficient of 0.72 because spreads are persistent. In the presence of the lagged yield, the CDS spread and the real effective exchange rate remain significant with the same signs as in regression (7).

We now turn to examining province-level and bond-level variables. In the terminology of asset pricing, we now include characteristics in the cross-sectional regression as opposed to just factor loadings (cf. Daniel and Titman, 1997). We still include the betas with respect to CDS, FX, and RF. Even though the province exposure to China's benchmark interest rate risk is marginally significant after controlling for other explanatory variables, it is significant in regression (7). Taking a conservative stance, we include these betas in our extended regressions investigating the role of real estate, political risk, and liquidity in the following sections.

4.3 Real Estate

To include real estate and other bond-level characteristics, we extend the framework to:

$$Y_{ijt} = \alpha_0 + \alpha Y_{ij,t-1} + \sum_{s=1}^{S} \xi_s \cdot X_{ijt} + \sum_{k=1}^{K} \gamma_k \cdot \beta_{j,F(k)} + \eta_t + \varepsilon_{ijt}, \tag{7}$$

where Y_{ijt} is the excess yield of chengtou bond i in province j in month t.[8]

We include S characteristics, which can be a function of bond i, like a liquidity measure, or a function of province j, like province-level economic growth. For the factor risk exposures, $\beta_{j,F(k)}$, we include $K = 3$ betas: the factor loadings on CDS, FX, and RF, given that these risk factors are priced in Table 6. The time-fixed effect, η_t, captures any unobservable (bond-invariant) factors that can influence chengtou yields not spanned by the factor risk exposures.

[8] Fang et al., 2015, document large price appreciation of houses in China since 2003 and find that land sales by local governments is an important determinant of housing prices. Regression (7) studies the opposite relation: real estate variables on the right-hand side, and chengtou bond yields on the left-hand side. It is an interesting research topic to study the joint pricing of chengtou bonds and real estate prices in equilibrium.

We estimate equation (7) as a panel regression. When running regression (7), we standardize the explanatory characteristic variables in the cross section each month. We do not standardize the lag of the excess yield or the betas. In this way, the estimated coefficients in the regression can be interpreted as the effect of a one standard deviation move in the cross section, so the economic scale is also comparable across variables. We take values of the characteristics available at time t, which are the figures made available at the end of the previous year prior to time t.

In Table 7, we investigate how real estate variables influence the cross section of chengtou bonds. In Panel A, we report the univariate regression coefficients taking just one real estate variable at a time. The effects of real estate risk are large. The coefficient on real estate GDP is -0.17, implying that if a given province moved by one standard deviation in the cross section, that province's chengtou bond yields would decrease by 0.17%. Given that the average excess chengtou bond yield is 1.98%, this is a large economic effect. Note that all the real estate regressions have relatively high R^2s of approximately 20%.

In Panel A, all the real estate variables are significant, but there are differences in sign. A priori we might expect that, like the negative coefficient on real estate GDP, higher real estate-related economic growth should indicate a lower risk of default because of higher collateral values, and thus lower yields. The coefficients for hotel GDP, GDP growth in general, and the fiscal gap, however, are positive. At first glance, this relation seems counter-intuitive. The reason for this unexpected sign is that provinces with higher GDP growth and higher fiscal surpluses also exhibit higher volatilities of growth.

Suppose we divide the provinces into High, Middle, and Low terciles similar to Table 4. Then provinces in the High tercile of fiscal surpluses have a mean of 20.7% and a standard deviation of 9.9%. The provinces in the Low fiscal surplus tercile have, by construction, the lowest mean of fiscal surpluses of 3.2% but also a low standard deviation of 3.0%. The same findings apply to GDP growth: the provinces with the highest average GDP growth also have the most volatile growth. The mechanical relation between high economic growth and high volatility drives the positive coefficients in the univariate regressions in Table 7, Panel A as these provinces are actually risky!

Panel B of Table 7 reports multivariate regression results. Regression (1) jointly takes the various GDP components. Real estate GDP and service GDP stand out, both with negative coefficients. In regression (2), we confirm the findings of the univariate regression that both variables positively predict excess chengtou bond yields, but this is driven by the positive relation between these economic variables and macro variability. In regression (3),

we consider the full set of province-level macro variables. This regression favors real estate GDP and service GDP. Regression (4) add the betas with respect to CDS, FX, and RF. In all the specifications, real estate GDP remains statistically significant. In regression (4), other province macro variables have insignificant effects on bond yields, after controlling for other province-level risks.

4.4 Political Risk

In Table 8, we run cross-sectional regressions (equation (7)) with our two political risk variables measuring corruption: the corruption index and the number of corruption cases, which we define in Section 3.5. We consider the corruption series individually in regressions (1) and (2). Both variables are significant, with higher levels of corruption corresponding to higher yields. A one standard deviation move of a province in the cross section from less to more corrupt increases excess chengtou bond yields by 0.09% for the corruption index and 0.05% for the number of corruption cases, respectively. The adjusted R^2s for these univariate regression is around 20%, which is relatively high because we use time fixed effects.

In regressions (3) to (5), we add the control variables: the betas with respect to CDS, FX, and RF changes, the bond ratings, and the lagged yield. In the presence of these risk characteristics, there is still a positive and highly statistically significant relation between the level of corruption and chengtou bond yields.

The negative coefficient on the bond rating in Table 8 is also interesting. Because of the way we construct the rating variable, higher values correspond to higher ratings. Thus, the significant negative coefficient on the rating variable indicates that bonds with higher ratings have lower yields. The fact that there are other significant variables in the regressions suggest that the ratings do not capture all the cross-sectional variation in chengtou bond yields.

4.5 Liquidity

Our final specifications investigate if liquidity is priced. In the first three regressions of Table 9, we examine turnover, the Amihud (2002) measure, and the High-Low spread, which is the difference between daily high and low prices. In the univariate regressions, only turnover and the Amihud measure are statistically significant. For the Amihud measure, a one standard deviation increase leads to a decrease of 0.04% in chengtou bond yields. The Amihud measure becomes insignificant in regression (4), controlling for all three liquidity

variables jointly, and in regressions (5) to (7) with the CDS, FX, and RF risk factor exposures, and lagged yields, respectively. Only the turnover ratio remains robust in the presence of province-level risk exposures, credit ratings, and the lagged yield in regressions(4) to (6).

The turnover coefficient is statistically significant across all regression specifications. The coefficient, however, is surprisingly positive: bonds with higher turnover should be more liquid bonds, and this should lead to lower yields as the greater liquidity should be attractive to investors. The positive sign between turnover and yields is reminiscent of the positive relation between volume and returns which Gervais, Kaniel, and Mingelgrin (2001) find in equity markets. Gervais, Kaniel, and Mingelgrin postulate that their finding of higher liquidity-higher returns is when a stock becomes more visible, it draws in a large number of potential buyers while the number of potential sellers remains the same. In the presence of short-sale constraints, the increase in visibility tends to increase expected returns (cf. Miller, 1977; Harrison and Kreps, 1978). Chinese markets fit these particular circumstances. Short-selling of securities is not permitted. Mei and Xiong (2009) note that speculative investors play a pronounced role in Chinese markets.

There is another possible channel contributing to the positive correlation between current turnover and chentou bond yields in the cross section. Speculators are most drawn to those bonds with the highest yields—the riskiest bonds. Consistent with this "reaching for yield," turnover is highest at 52.4% for AA-rated bonds, and lowest at 32.4% for AAA-rated bonds.

In regression (7), we introduce an interaction term between turnover and high-quality bonds. The latter variable is a dummy which is equal to one if the bond credit rating is AAA, and zero otherwise. Although the Amihud measure is insignificant in the multivariate regressions (regressions (4) to (6)), it is significant in the univariate specification (regression(2)), so for completeness we also include an interaction term between the Amihud measure and high-quality bonds. Table 9, regression (7) shows that while the coefficient on turnover remains significantly positive, the coefficient on the interaction term between turnover and high quality is negative. Thus, within the high-credit category, bonds with high turnover ratios have lower yields.

5 Conclusion

Chengtou bonds play an important role in funding Chinese local governments. The market experiences tremendous growth after the 2008 global financial crisis and as of December 2014,

there are RMB 4.95 trillion ($0.82 trillion) of chengtou bonds outstanding. The Chinese central government is ultimately responsible for the finances of all local governments, but despite the guarantee, we find large heterogeneity in chengtou bond yields.

Reflecting the systemic risk of chengtou bonds, we find that variables reflecting aggregate credit risk, monetary policy, and the real effective exchange rate are priced in the cross section. We find that real estate values are important drivers of chengtou bonds, which is not surprising given that their collateral value is directly linked to the real estate market. We also find that chengtou bond yields reflect corruption risk: we construct an index of corruption based on officials investigated by the Central Commission for Discipline Inspection (CCDI). We find a significantly positive correlation between risk-adjusted chengtou bond yields and the corruption index.

The rules governing local government finances in China are changing. In October 2014, the State Council issues Rule No. 43 which states that starting from January 1, 2016, LGFVs are no longer allowed to issue chengtou bonds. This effectively shuts down chengtou bonds as a source of funds for local governments. Instead, local governments will rely on alternative financing channels: (1) issuing regular municipal bonds for public-interest projects fully backed by tax revenue, (2) forming public-private partnerships for infrastructure developments which do not carry a government guarantee, and (3) issuing private corporate debt for non-public (commercial) real estate projects.

These developments mean that although the amounts outstanding are large, chengtou bonds are likely to become a legacy asset. At present, chengtou bonds are the only local government asset where market prices are observable. Thus, the pricing of credit risk, political risk, real estate risk, and other province and bond-level characteristics in chengtou bonds provides a unique opportunity to study how these types of risk impact Chinese local government finances in general.

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Table 1: **Chengtou Bond Issuance**

The table reports chengtou bond issuance in terms of the number of bonds issued each year and the issue amounts in billions of RMB broken down by maturity buckets: less than or equal to one year, (0,1]; between one and three years, (1,3]; between three and seven years, (3,7]; and between seven and 30 years, (7,30]. We also report the issue amounts outstanding at the end of each year.

	Number of Bonds Issued (Years)					Issue Amount (Bil RMB)					
Year	(0,1]	(1,3]	(3,7]	(7,30]	Total	(0,1]	(1,3]	(3,7]	(7,30]	Total	Outstanding (Bil RMB)
1997	0	0	1	0	1	0	0	0.5	0	0.5	0.5
1998	0	3	2	0	5	0	0.9	0.8	0	1.7	2.2
1999	0	1	2	1	4	0	0.2	1.1	0.8	2.1	4.3
2000	0	2	3	0	5	0	0.3	2.1	0	2.4	6.7
2001	0	0	0	0	0	0	0	0	0	0	5.8
2002	0	0	0	5	5	0	0	0	7.5	7.5	12.6
2003	0	0	0	8	8	0	0	0	16.6	16.6	28.1
2004	0	0	1	4	5	0	0	1.4	7	8.4	35.4
2005	12	0	6	25	43	18.2	0	7	33.3	58.5	91.8
2006	19	0	3	37	59	23.1	0	1.8	44.3	69.2	142.3
2007	34	0	1	38	73	42.1	0	1.5	43.8	87.3	205.2
2008	36	4	32	7	79	49.3	8.5	50.7	11.7	120.2	280.9
2009	40	11	162	45	258	45.6	22.6	248.7	92.4	409.3	648.3
2010	68	17	156	47	288	79.4	19.9	203.2	72.8	375.3	964.2
2011	74	26	243	41	384	70.7	33.4	314.3	63.3	481.6	1362.2
2012	139	49	763	76	1027	133.1	35.6	930.1	109.1	1207.8	2469.4
2013	184	78	678	44	984	210.5	51.6	816.3	95.5	1173.8	3435.3
2014	352	139	1129	84	1704	381.9	56.01	1303.1	159.0	1900.0	4954.5
Total	958	330	3182	462	4932	1053.9	229.0	3882.5	756.9	5922.3	

Table 2: **Yield at Issue (%) by Maturity (Years)**

The table breaks down chengtou issuance by maturity buckets: less than or equal to one year, (0,1]; between one and three years, (1,3]; between three and seven years, (3,7]; and between seven and 30 years, (7,30].

	(0,1]	(1,3]	(3,7]	(7,30)	Average
1997			12.50		12.50
1998		7.64	9.00		8.32
1999		3.78	5.10	4.32	4.40
2000		3.72	4.00		3.86
2002				4.40	4.40
2003				4.43	4.43
2004			5.30	5.72	5.51
2005	2.95		4.58	4.98	4.17
2006	3.55		4.00	4.20	3.92
2007	4.38		1.00	5.19	3.52
2008	5.03	5.83	6.14	6.46	5.87
2009	2.72	3.75	6.10	6.13	4.68
2010	3.40	4.43	5.90	6.04	4.94
2011	5.64	5.76	6.88	7.06	6.33
2012	5.09	6.12	6.95	7.02	6.29
2013	5.40	6.88	6.58	6.07	6.23
2014	5.41	8.16	7.16	6.80	6.88

Table 3: **Chengtou Bond Issuance by Province**

The table reports chengtou bond issuance broken down by province. Integer values are assigned to ratings: one for A increasing to six for AAA. We report the average maturity and rating. Amount is in RMB billion.

	At Issue			Outstanding			
Province	Amount	Bonds	Issuers	Amount	Bonds	Maturity	Rating
Jiangsu	949.89	844	223	745.78	689	5.20	3.80
Zhejiang	418.58	426	120	360.09	362	6.11	3.63
Beijing	390.37	199	25	246.10	125	5.14	4.68
Shanghai	296.83	221	43	162.93	119	5.09	4.45
Guangdong	280.10	198	56	227.65	145	5.92	4.12
Shandong	272.57	246	73	256.07	232	6.56	3.67
Hunan	270.90	207	56	249.58	193	6.39	3.56
Chongqing	268.55	219	61	254.55	205	6.49	3.74
Tianjin	259.62	155	38	209.07	124	5.44	4.03
Anhui	258.24	229	53	222.64	196	6.02	3.64
Sichuan	233.97	216	64	202.92	183	5.27	3.53
Hubei	194.92	169	43	176.30	151	6.72	3.76
Liaoning	192.45	152	47	190.55	145	6.96	3.25
Jiangxi	185.05	165	35	154.20	135	5.80	3.81
Fujian	175.54	189	46	148.54	154	5.51	3.62
Henan	143.35	124	38	133.85	109	6.82	3.57
Shaanxi	128.70	103	30	101.10	85	5.06	3.69
Hebei	118.05	98	26	112.15	89	7.40	3.73
Yunnan	117.60	105	26	105.95	94	5.95	3.57
Guangxi	116.61	119	29	98.81	98	5.91	3.63
Guizhou	102.50	80	30	100.80	78	7.15	3.20
Xinjiang	96.22	103	34	85.52	84	5.86	3.26
Gansu	95.00	63	13	71.90	52	5.43	3.82
Inner Mongolia	92.25	80	29	85.30	72	6.72	3.38
Heilongjiang	80.98	74	19	77.58	70	6.75	3.40
Shanxi	59.55	44	15	57.85	41	7.06	3.36
Qinghai	49.10	41	8	44.00	34	7.15	3.63
Jilin	44.47	39	10	42.47	37	6.90	3.68
Hainan	16.40	12	3	16.40	12	6.51	3.67
Ningxia	13.90	12	5	13.90	12	8.22	3.75
Total	5922.25	4932	1298	4954.54	4125	6.25	3.69

Table 4: **Summary Statistics**

The table reports the distribution statistics of the excess yield on chengtou bonds (see Section 3.1) based on transaction data (Panel A) and chengtou bond liquidity statistics (Panel B). Panel A also reports the bond excess yield distribution subdivided by four criteria based on province-level characteristics: (1) geography, (2) the local fiscal surplus to GDP ratio, (3) local GDP growth rate, and (4) real estate rank (measured by the average price per squared meters during 2008 to 2012). In Panel B, "Amihud" denotes the Amihud (2002) variable. P10 and P90 denote the 10th and 90th percentiles, respectively. The sample period is from 2007 to 2014.

Panel A: Excess Yields (%)

	Mean	Median	Stdev	P10	P90
All Bonds	1.98	1.90	0.81	1.11	2.98
Geography					
Coastal	1.87	1.77	0.81	1.04	2.83
Middle	2.15	2.11	0.83	1.19	3.19
West	2.21	2.16	0.75	1.34	3.10
Fiscal Surplus					
High	2.37	2.35	0.76	1.43	3.29
Middle	2.13	2.07	0.79	1.24	3.09
Low	1.85	1.76	0.80	1.03	2.81
GDP Growth					
High	2.09	2.00	0.80	1.25	3.05
Middle	2.10	2.06	0.81	1.20	3.07
Low	1.79	1.69	0.79	0.97	2.79
Real Estate Rank					
High	1.92	1.81	0.81	1.08	2.90
Middle	2.08	2.03	0.81	1.14	3.11
Low	2.17	2.18	0.76	1.26	3.07

Table 4 (Continued): Summary Statistics

Panel B: Liquidity Characteristics

	Mean	Median	Stdev	P10	P90
Spread	0.21	0.00	0.74	0.00	0.51
Amihud	32.87	1.37	115.75	0.03	51.87
Turnover	42.58	14.00	98.95	0.25	101.00

Table 5: **Provinces Sorted on Macro Factor Betas**

We estimate province-level betas by regression changes in yields on changes in nation-wide macro factors (equation (5)). We aggregate bond-level yields to the province level for the dependent variable. The macro factors are the change in the credit default swap rate (ΔCDS), the change of foreign direct investment to China (ΔFDI), the change of the log of the current account (ΔCA), the change of the effective real exchange rate (ΔFX), the change in the one-year time deposit rate, (ΔRF), and the stock market return, (RET). In Panel A, we report summary statistics of the betas. In Panel B, we sort provinces on the betas into three portfolios: High, Medium, and Low. We report chengtou bond excess yields (in percentages) of the High and Low portfolios, and report a the t-test for the difference of average returns across the High and Low portfolios. The sample period is from August 2007 to December 2014.

	$\beta_{\Delta CDS}$	$\beta_{\Delta FDI}$	$\beta_{\Delta CA}$	$\beta_{\Delta FX}$	$\beta_{\Delta RF}$	β_{RET}
Panel A: Summary Statistics of Betas						
Mean	0.14	0.11	-0.01	0.00	-0.33	0.12
Median	0.30	0.21	0.07	0.03	0.96	0.69
SD	0.13	0.09	-0.02	0.00	-0.12	0.16
P10	-0.15	-0.14	-0.04	-0.03	-0.92	-0.77
P90	0.35	0.34	0.03	0.03	0.25	1.02
Panel B: Excess Yields (%) Sorted by Macro Betas						
Low	1.91	1.89	1.98	2.05	2.15	2.11
High	2.15	2.10	2.13	1.97	1.94	2.01
Low-High	-0.24	-0.21	-0.16	0.07	0.21	0.09
t-statistics	-5.52	-5.51	-3.82	1.81	5.15	2.49

Table 6: **Macro Risk**

We run the cross-sectional regression (6) of province-level yields on the left-hand side and betas of macro factors on the right-hand side. The betas are estimated in a first-pass time-series regression (5). We also include the lagged yield as an independent variable. The coefficients on the factor loadings represent the price of risk of: the credit default swap on the Chinese central government (CDS), the log of foreign direct investment (FDI), the log of current account (CA), the effective real exchange rate (FX), the one-year time deposit interest rate (RF), and the Chinese stock market return (RET). Estimates with statistical significance at the 90% level or above are highlighted in bold. The sample period is from August 2007 to December 2014.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CDS	**0.35**						**0.39**	**0.09**
	[5.71]						[6.50]	[2.21]
FDI		**0.18**					0.13	0.02
		[2.12]					[1.38]	[0.34]
CA			**1.25**				0.56	0.00
			[3.38]				[1.50]	[0.01]
FX				0.19			**-2.62**	**-0.84**
				[0.29]			[-3.89]	[-1.84]
RF					**-0.12**		**-0.10**	-0.02
					[-4.52]		[-3.37]	[-0.89]
RET						0.02	0.03	0.01
						[0.76]	[1.33]	[0.37]
Lagged Yield								**0.72**
								[19.69]
Number of Observations	2,110	2,110	2,110	2,110	2,110	2,110	2,110	2,100
Adjusted R^2	0.020	0.003	0.014	0.000	0.026	0.033	0.048	0.580

Table 7: **Real Estate Risk**

The table reports the cross-sectional regression estimates of equation (7) with province-level real estate variables. We include three factor loadings: credit default swap rates on the Chinese central government (CDS), the real effective exchange rate (FX), and the policy interest rate (RF), which is the one-year time deposit rate. The regression is run at the bond level at the monthly frequency. We average bond yields over each month to obtain monthly frequency values. We consider the real estate variables enumerated in Section 3.4. Panel A reports coefficient estimates of each real estate variable taken separately. Panel B reports multivariate cross-sectional regressions, including including the CDS, FX, and RF risk factor exposures as control variables. Standard errors are clustered at the bond level, and corresponding t-statistics are reported. Estimates with statistical significance at the 90% level or above are highlighted in bold. The sample period is from August 2007 to December 2014.

Panel A: Univariate Regression

	Coefficient	t-stat	R^2
GDP Growth	**0.12**	7.31	0.21
Fiscal Gap	**0.12**	6.74	0.21
Real Estate GDP	**-0.17**	-9.69	0.21
Service GDP	**-0.06**	-10.23	0.22
Retail GDP	**-0.05**	-10.38	0.22
Hotel GDP	**0.12**	2.95	0.19
Land Cost	**-0.04**	-2.61	0.19
Loans to Real Estate	**-0.15**	-6.78	0.22

Table 7 (Continued): Real Estate Risk

Panel B: Multivariate Regressions

	(1)	(2)	(3)	(4)
Real Estate GDP	**-0.03**		**-0.03**	**-0.04**
	[-5.03]		[-3.80]	[-4.83]
Service GDP	**-0.01**		**-0.01**	-0.01
	[-1.85]		[-1.91]	[-1.00]
Retail GDP	0.01		0.01	0.00
	[1.23]		[1.30]	[0.10]
Hotel GDP	0.01		0.01	-0.01
	[0.55]		[0.57]	[-0.32]
GDP Growth		**0.02**	0.00	-0.01
		[2.94]	[0.50]	[-1.27]
Fiscal Gap		**0.01**	0.00	0.00
		[2.31]	[-0.66]	[0.07]
$\beta_{\Delta CDS}$				0.04
				[1.61]
$\beta_{\Delta FX}$				**-0.86**
				[-3.38]
$\beta_{\Delta RF}$				**-0.03**
				[-2.34]
Lagged Yield	**0.78**	**0.77**	**0.78**	**0.77**
	[43.15]	[46.23]	[42.97]	[43.09]
Month Fixed Effects	Y	Y	Y	Y
Number of Observations	16,238	18,741	16,194	16,194
Adjusted R^2	0.628	0.620	0.628	0.628

Table 8: **Corruption Risk**

The table reports the cross-sectional regression estimates of equation (7) with political risk corruption index. We use two proxies for political risk: a weighted ranking of corrupt officials in each province computed using data from the CCDI's website (*Corruption*), and the number of officials listed in graft cases in each province (*Number of Corruption Cases*). We include three factor loadings: credit default swap rates on the Chinese central government (CDS), the real effective exchange rate (FX), and the policy interest rate (RF), which is the one-year time deposit rate. We also include the bond rating as a control variable. The regression is run at the bond level at the monthly frequency. We average bond yields over each month to obtain monthly frequency values. Standard errors are clustered at the bond level, and corresponding t-statistics are reported. Estimates with statistical significance level 90% or higher are highlighted in bold. The sample period is from August 2007 to December 2014.

	(1)	(2)	(3)	(4)	(5)
Corruption	**0.09**		**0.02**	**0.02**	**0.02**
	[4.33]		[4.39]	[4.01]	[3.59]
Number of Corruption Cases		**0.05**	**0.01**	**0.02**	**0.01**
		[3.09]	[2.92]	[4.12]	[2.03]
$\beta_{\Delta CDS}$				**0.05**	**0.06**
				[2.18]	[2.99]
$\beta_{\Delta FX}$				**-0.51**	**-0.57**
				[-2.58]	[-3.11]
$\beta_{\Delta RF}$				**-0.02**	**-0.01**
				[-2.66]	[-1.72]
Rating					**-0.09**
					[-12.3]
Lagged Yield			**0.77**	**0.77**	**0.71**
			[49.1]	[48.66]	[37.19]
Month Fixed Effects	Y	Y	Y	Y	Y
Number of Observations	20,342	20,342	18,772	18,772	18,772
Adjusted R^2	0.198	0.191	0.620	0.621	0.630

Table 9: **Liquidity Risk**

The table reports the cross-sectional regression estimates of equation (7) with liquidity characteristics. We use three liquidity measures: Turnover, which is the monthly trading volume divided by the total amount outstanding; the Amihud (2002) illiquidity measure, which is the absolute bond return divided by daily trading volume at the monthly frequency; and the High-Low spread, which is the difference between high and low prices. High Quality denotes a dummy variable equal to one if the bond rating is AAA. We include three factor loadings: credit default swap rates on the Chinese central government (CDS), the exchange rate (FX), and the policy interest rate (RF), which is the one-year time deposit rate. We also include the bond rating as a control variable. The regression is run at the bond level at the monthly frequency. We average bond yields over each month to obtain monthly frequency values. Standard errors are clustered at the bond level, and corresponding t-statistics are reported. Estimates with statistical significance levels at the 90% or above are highlighted in bold. The sample period is from August 2007 to December 2014.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Turnover	**0.07**			**0.02**	**0.02**	**0.01**	**0.02**
	[4.42]			[3.77]	[3.77]	[3.26]	[3.41]
Turnover × High Quality							**-0.01**
							[-1.65]
Amihud		**-0.04**		0.01	0.01	0.01	0.01
		[-3.23]		[1.07]	[1.11]	[1.64]	[1.08]
Amiud × High Quality							0.00
							[-0.28]
High-Low Spread			0.00	0.00	0.00	0.00	
			[-0.17]	[-0.74]	[-0.65]	[0.29]	
$\beta_{\Delta CDS}$					**0.07**	**0.09**	**0.09**
					[3.01]	[3.67]	[3.69]
$\beta_{\Delta FX}$					**-0.54**	**-0.72**	**-0.71**
					[-2.96]	[-4.39]	[-4.31]
$\beta_{\Delta RF}$					0.00	0.00	0.00
					[-0.47]	[-0.09]	[-0.04]
Rating						**-0.08**	**-0.08**
						[-11.77]	[-11.76]
Lagged Yield				**0.80**	**0.80**	**0.74**	**0.74**
				[52.3]	[52.4]	[40.3]	[40.4]
Month Fixed Effects	Y	Y	Y	Y	Y	Y	Y
Number of Observations	20357	15646	20357	14472	14472	14472	14472
Adjusted R^2	0.195	0.201	0.187	0.675	0.676	0.684	0.684

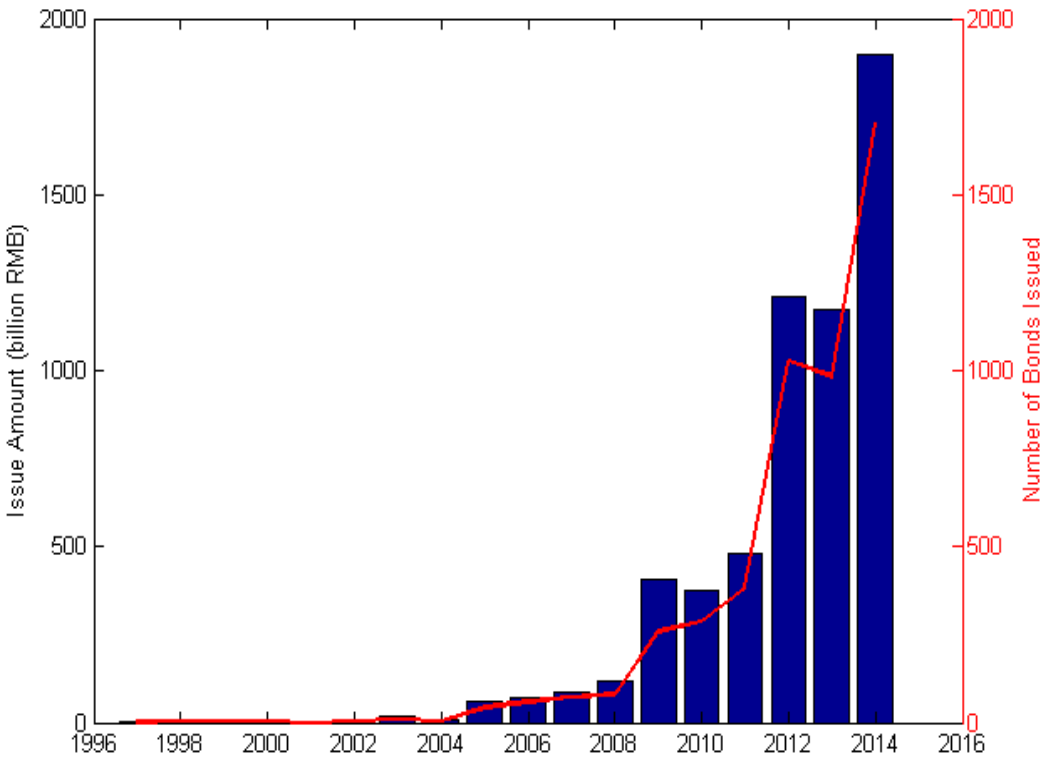


Figure 1: Annual Issues of Chengtou Bonds

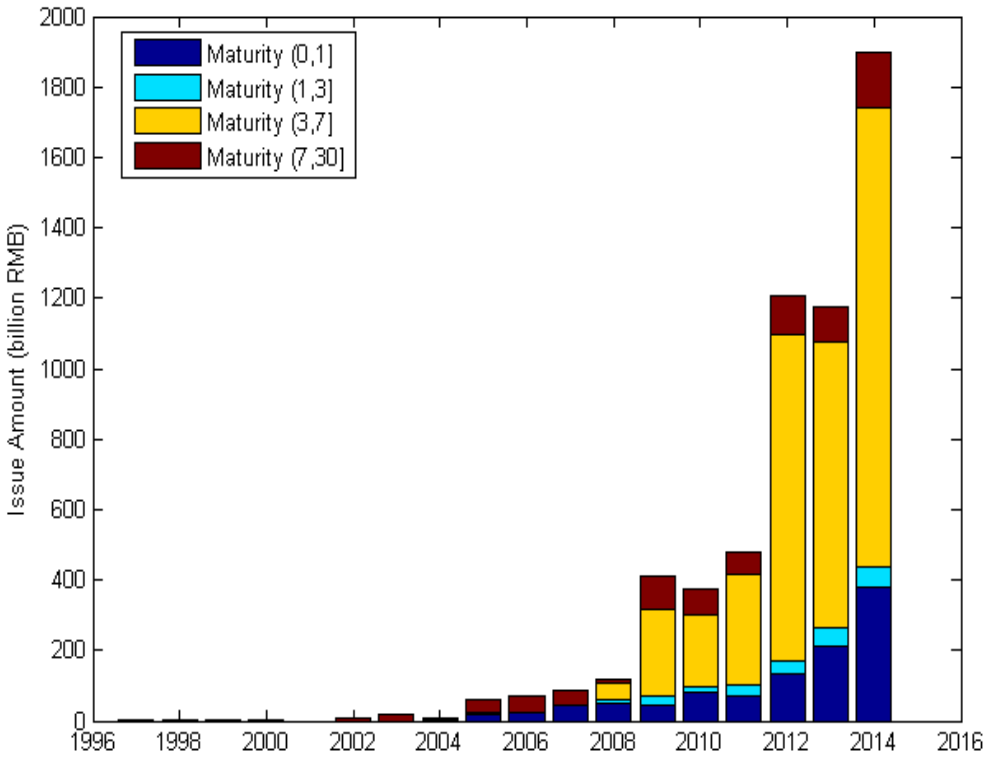


Figure 2: Tenor Decomposition of the Annual Chengtou Bond Issuance

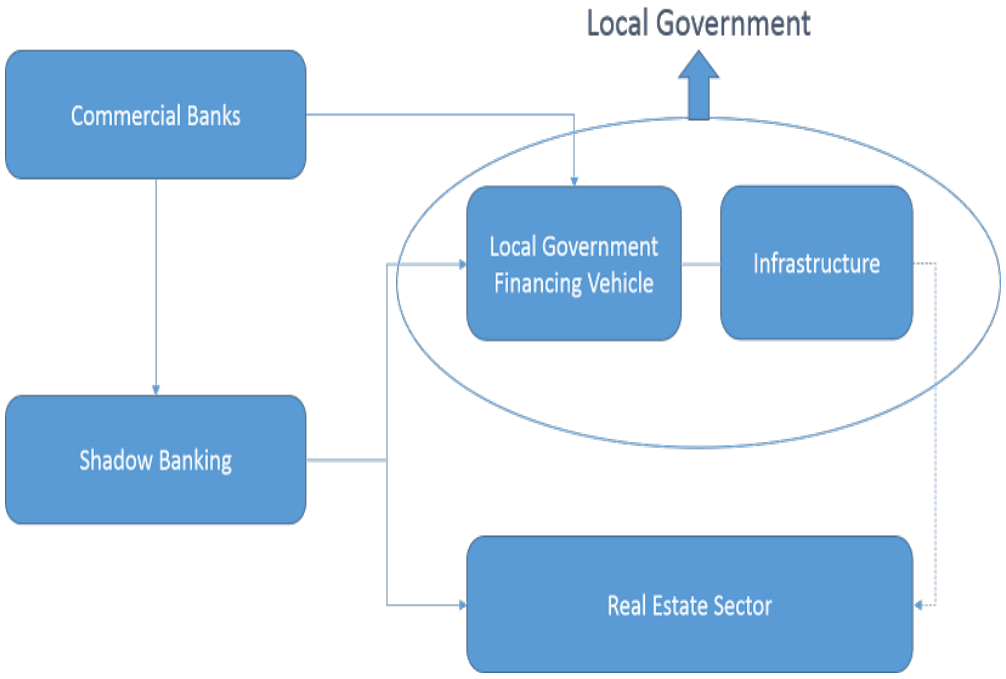
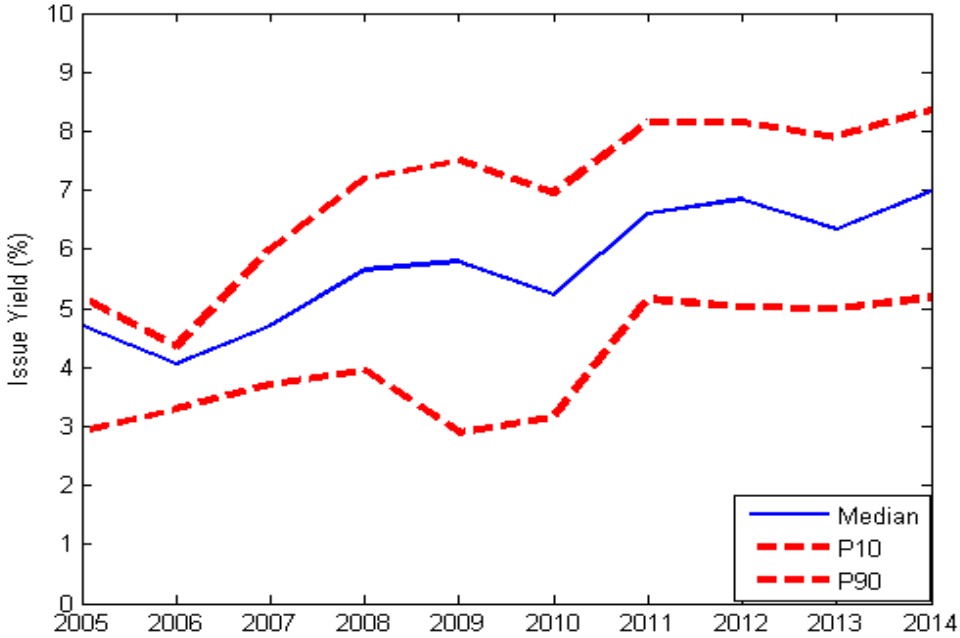


Figure 3: The Nexus of Chinese Local Government Debt

Panel A: Issue Yields in the Primary Market



Panel B: Excess Yields in the Secondary Market

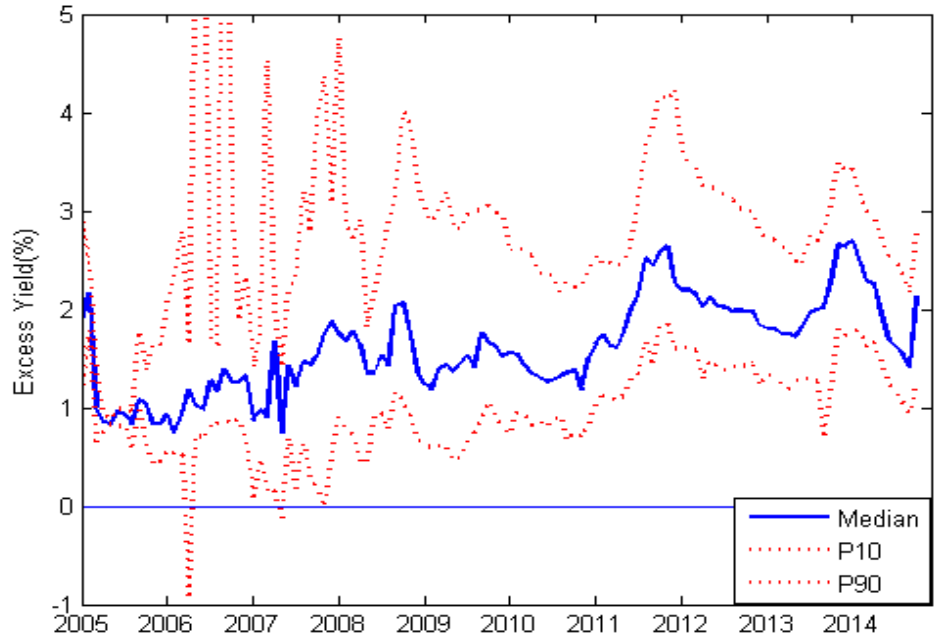


Figure 4: **Dispersion of Chengtou Bond Yields**